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VOLUME XXX SEPTEMBER, 1931 NUMBER 6

THE SULPHUR INDUSTRY OF THE GULF COAST

W. A. BROWNE
State Teachers College, Nacogdoches, Texas

At the ports of Galveston and Freeport one may see thousands of tons of sulphur transferred across the docks. Trainload after trainload of the bright yellow mineral arrive; into the holds of huge ocean freighters the contents are poured and soon the vessel steams out to sea (Fig. 7). As other trains and other ships arrive to repeat the process the observer becomes curious concerning the source of this product of such enormous quantity. Upon inquiry it is learned that only a short journey takes one to the fields in which is produced approximately 90 per cent of the world's sulphur.

Mining activities began in southern Louisiana about 1885, but not until the first decade of the present century did production become important. Operations in that area continued until the deposits were exhausted, in 1925. In the meantime other and more important fields were developed in the coast lands of Texas, the present source of our sulphur supply.

LOCATION AND EXTENT

Sulphur-bearing formations are found at various points over that section of the Gulf Coast which in general lies between the Mississippi River and Rio Grande and extends some 150 miles inland (Fig. 1). Altho the extent of the area would suggest widespread operations yet in only a few places has mining been carried on. At present activities are confined to Freeport, Gulf, and Newgulf or Boling (Fig. 2). Two deposits are worked about Freeport, one at Bryand Mound three miles southwest of the town and one at Hoskins Mound about fourteen miles in the opposite direction. A minor quantity is now obtained from a shallow deposit at Duval in west Texas.

Subsequent to 1923 the discovery of salt domes, in which sulphur

is found in varied quantities, has been greatly accelerated by the use of geophysical instruments, principally the torsion balance and seismograph. The number of dome discoveries now approximates 125, but this does not include some 30 domes of Texas and Louisiana which lie at a minimum distance of 150 miles from the coast. Altho sulphur in varying amounts is present in many of

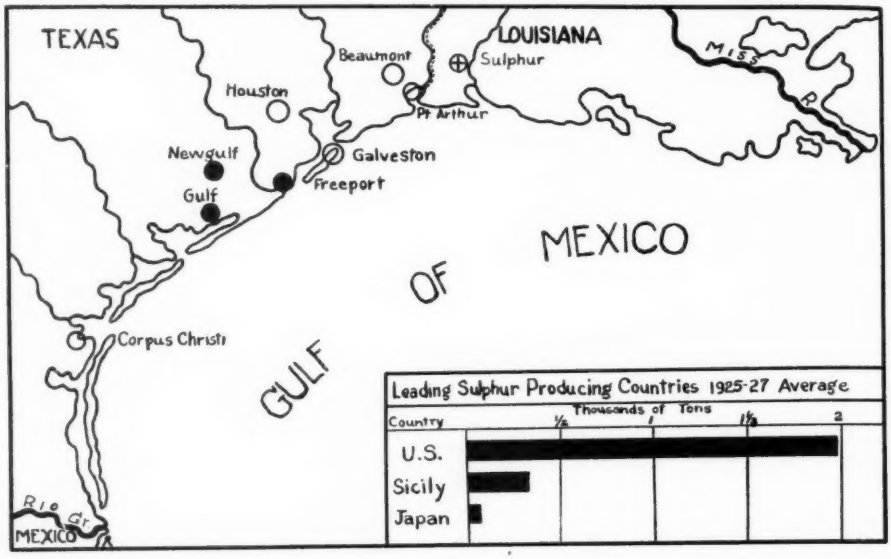

FIG. 1. The general region of sulphur formations lies between the Mississippi River and Rio Grande and extends some 150 miles inland. Thus far most of the mining has been done within a few miles of the coast. Solid color denotes active mining towns. Inset shows the predominance of the United States in the sulphur world.

these formations in only five or six has this mineral been found in commercial quantities.[1]

FORMATION AND OCCURRENCE

The origin of the sulphur deposits still remains somewhat obscure. Perhaps the most frequently proposed theory for the origin of salt domes is that pressure from overlying Tertiary and Quarternary formations aided in bringing about intrusions of the semiplastic salt (formed as a lower strata at a very early age) thru the lower consolidated materials. Among the theories that have been proposed to explain the origin of sulphur may be included the

[1] W. T. Lundy, Mining Engineer, Freeport Sulphur Company.

alteration of calcium sulphate to calcium carbonate and sulphur; and another theory is that sulphur may be formed by the reduction of hydrogen sulphide gas which occurs very commonly in the Gulf Coast salt domes.[2] The mounds are circular in outline and vary from one-eighth mile to one and one-half miles in horizontal diameter with surface elevations but slightly observable. Since the mounds trend in somewhat parallel lines which also roughly parallel the Balcones Escarpment it is concluded that the intrusions occurred at the intersections of major faults.

Sulphur is found in the caprock portion of the dome. "The normal order of occurrence is porous rock and sulphur bearing limestone underlain by barren and impervious anhydrite, which in turn lies in well defined contact upon the salt. The sulphur-bearing strata vary in thickness from a few feet to upwards of 250 feet and lie at various depths. Early discoveries in Louisiana were from 600 to 800 feet below the surface, but the more recent wells of Texas range from 1,000 to 1,500 feet in depth. The sulphur content thru the rock is equally variable. Apparently the mineral has collected in por-

[2] Ibid.

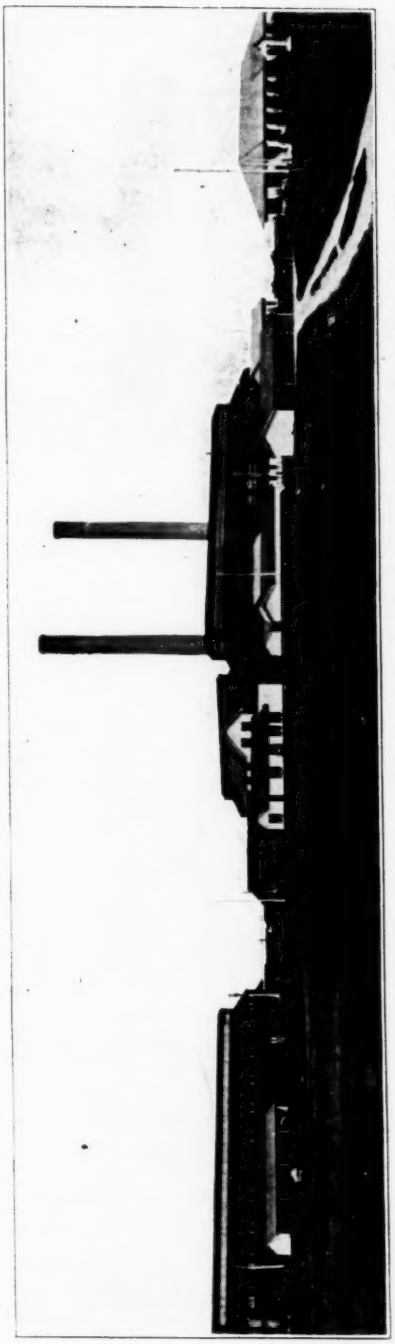

FIG. 2. Plant of the Texas Gulf Sulphur Co., at Gulf, Texas. The towering smokestacks and huge buildings are made unusually conspicuous by the all but complete absence of other development on the level coastal plain. Courtesy Texas Gulf Sulphur Co.

ous rock, in which the cavities make up from 50 per cent of the strata down to mere traces. The sulphur content varies accordingly with its purity maintained thru the small as well as thru the larger spaces.

MINING

Sulphur mining in the region has undergone varied experiences. Early attempts in Louisiana by shaft and tunnel methods resulted in failure because of poisonous gases encountered in the unconsoli-

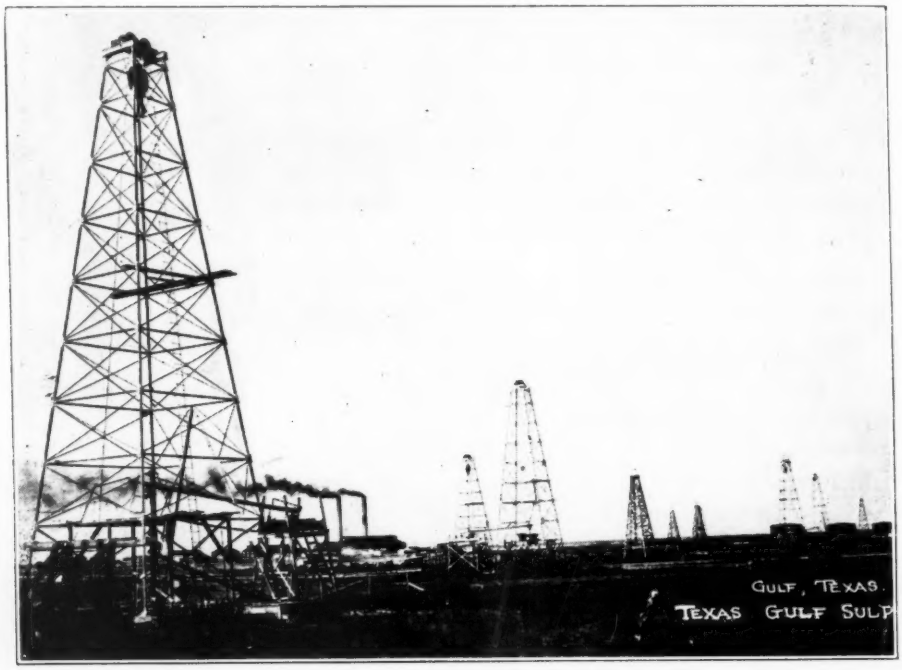

FIG. 3. Sulphur field with mining activities under way at Gulf, Texas. In general appearance the fields resemble closely an oil field. Courtesy Texas Gulf Sulphur Co.

dated coastal sediments. In fact several miners perished in these first experiments. Successful operations were made possible by the invention of the Frasch process, patented 1891. More than a decade of time and effort then elapsed before American production was felt in world markets. The process, named for its inventor, is essentially a hot water method by which water under pressure is raised to temperatures above 300° F. and pumped into the sulphur deposits. Wells, drilled with derrick and other

apparatus not unlike that used in drilling for oil (Fig. 3), are equipped with a set of concentric pipes part of which are used for injecting the hot water and steam or compressed air into the wells while the others act as discharge pipes for the air and liquid sulphur (Fig. 4). After being pumped into the wells the hot water passes out thru the perforated lower portion of the intake pipes and permeates the porous rock, melting the sulphur wherever contact is made. While working its way downward a portion of the molten sulphur enters the lower section of the outlet piping, but it is not known what percentage is lost thru percolation in other directions. In some cases the overlying gumbo and shales together with the previously noted anhydrite base provide almost impervious layers about the domes. Under such conditions a minimum amount of hot water is required to operate the wells. Water which has migrated thru the formations and cooled is removed by "bleed wells"

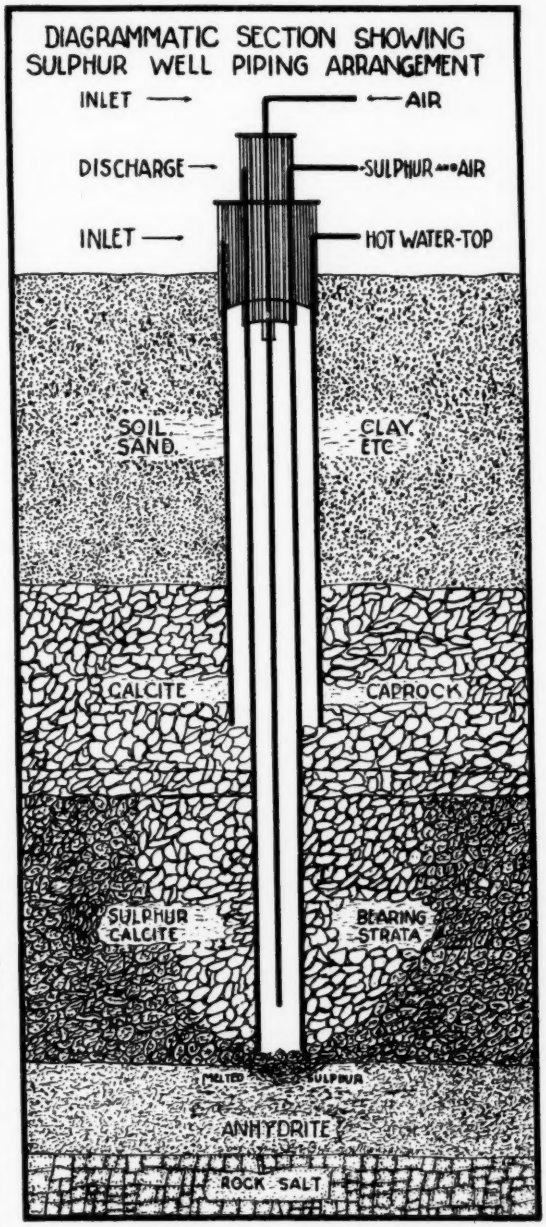

FIG. 4. Illustration of well arrangement in the Frasch process of mining sulphur. After "Mining of Sulphur" (pamphlet) prepared by Texas Gulf Sulphur Co.

which tap the deposit some distance from the steaming zone. Where domes are enveloped in more porous materials, naturally more water escapes with a corresponding increase in operating expenses. The height to which the liquid sulphur rises in an active well may be one-half or two-thirds its depths, depending on the static pressure and the pressure of the water that has been forced into the porous rock. Finally, compressed air released near the bottom of the well provides an air-lift which discharges the sulphur. Due to the movement of the substances thru porous rock the reddish-brown liquid

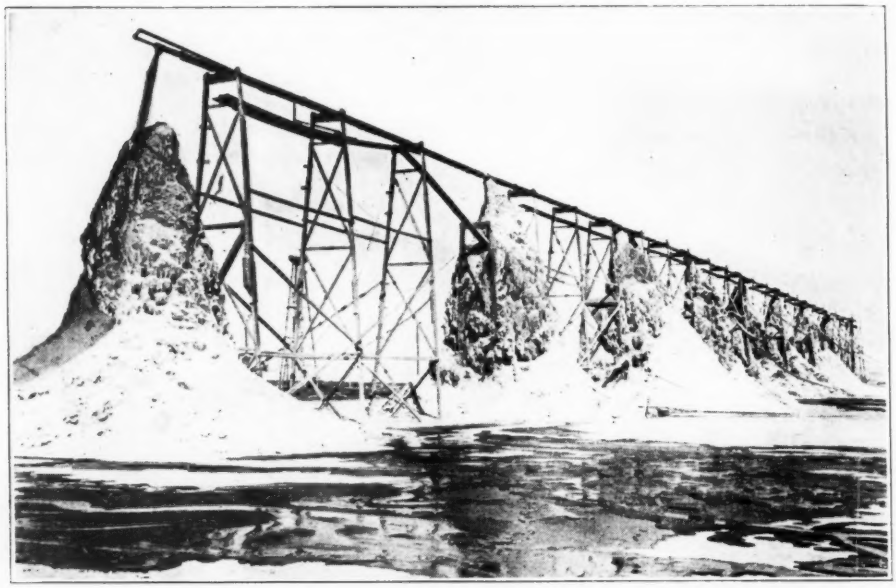

FIG. 5. Transfer line depositing sulphur in a vat. Since sulphur solidifies readily stacks form under the vents, similar to the formation of stalagmites.

issues from the well in spurts. The flow may be continuous or intermittent, and a well which produces sixteen hours a day is considered a fair average.

TRANSFERENCE AND STORAGE

Ordinarily three processes are required to transfer the sulphur from the place of production to final storage. From the discharge pipe at the top of the well it pours into a cubical open-topped tank of a few yards dimensions, built largely underground. To prevent solidification such tanks, called relay stations or sumps, are lined on the bottom and about the sides with steam pipes which keep

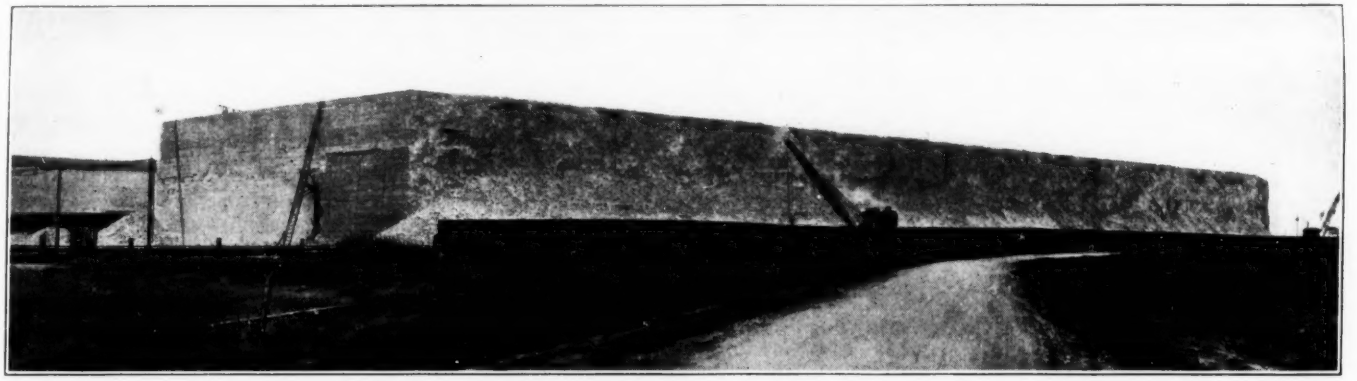

FIG. 6. Another conspicuous figure on the Coastal Plains landscape. A typical storage block of sulphur after the vat has been removed. Such a block may contain one-half million tons. Courtesy Texas Gulf Sulphur Co.

FIG. 7. Loading sulphur at the port of Galveston for ocean shipment. Storage bins and railway trackage in rear not shown. The sulphur may be sent to our Atlantic or Pacific coast, or to some foreign country, as Canada, Germany, or Australia. Courtesy Texas Gulf Sulphur Co.

the sulphur in essentially the same state that it flows from the well. Occasionally, as sufficient quantities collect in the sumps, the liquid is pumped thru insulated pipes containing small steam lines (to maintain the high temperature) to the large vats for solidification and storage. The transfer line leads out lengthwise over the vat and discharges the sulphur at intervals of a few yards (Fig. 5). From these vents the molten material spreads evenly over the surface as the mass builds higher and higher. Wells very near may discharge directly into the storage bin.

The vat is a very simple structure. It is rectangular in shape, the sides of which are of lumber overlapped and fitted close enough to insure sulphur-tight forms. The dimensions vary according to the scope of operations, but ordinarily range between 300 and 800 feet in length and one-third or more as great in width. The sides are kept built slightly above the surface of the rising mass, and are held erect by timbers extending inward which become set in the sulphur as it solidifies, making unnecessary any outside bracing.

The completed block is similar in appearance to a large flat-topped two- or three-story building (Fig. 6). It stands 40 or 50 feet in height and may contain one-half million tons of sulphur. When the mass is cooled, the walls are of no further use; since sulphur is stable under ordinary temperatures. The great dimensions of a vat serve two purposes—for storing enormous quantities of the product and for permitting the sulphur flow to spread over considerable area which insures thoro cooling. If a pocket or pool of the molten material is formed and crusts over, due to low heat conductivity, it may remain in this state for a year which is a source of danger as well as a hindrance in removing the product. Without further treatment the sulphur is guaranteed to analyze 99.8 per cent to 99.9 per cent pure, and the final test runs 99.96 per cent to 99.98 per cent. A minor portion of the material is refined into the product known as flowers of sulphur or "drugstore sulphur," and a large plant for this work is located at Freeport.

Removal and Disposal of the Product

The cooled mineral is ready for shipment and use for most purposes. In this condition sulphur is very hard and considerable effort is required in breaking it down for shipping. Blasting with powder prepares the material for loading save occasional large

pieces that are further broken with picks. From the broken down face large clam-shell loaders lift the sulphur into railway cars, placed on conveniently located movable tracks (Fig. 7). Much of the product moves by rail directly to interior centers of consumption, but a far greater portion reaches the nearby ports of Galveston and Freeport. Freeport handles approximately 80 per cent of the product of that locality. Corpus Christi receives a minor quantity from western Texas.

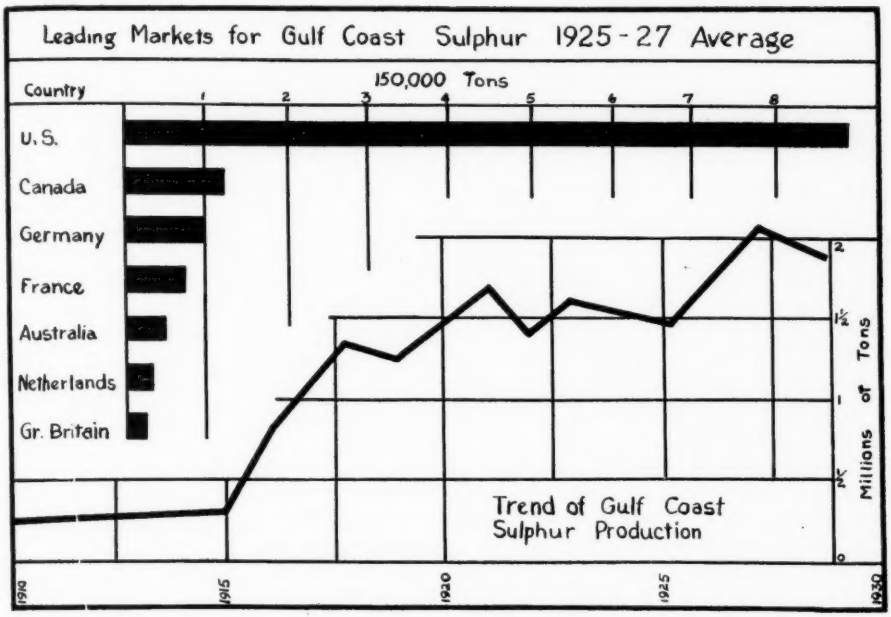

FIG. 8. Gulf coast sulphur reaches various countries of the world, but the major part remains at home. Compare with Fig. 1 to get the relation between sulphur producers and users over the world. Lower graf shows steady upward trend of production.

Both Galveston and Freeport have provided special equipment for handling sulphur moving by steamers. On the sulphur dock at Galveston are two storage bins of 35,000 tons combined capacity arranged parallel to each other with trackage space between for railway cars, movable cranes, and other fixtures. Of the three intervening tracks the central position is occupied by the cranes, movable hoppers, and conveyor belts, while the tracks on either side are reversed for railway cars that have brought in sulphur for storage in the bins, temporary storage in the cars, or delivering their loads to vessels for immediate shipment. Such arrangement

provides a convenient position for the cranes to transfer the product from cars to storage bins, from cars to hoppers, or from storage bins to hoppers. From the automatic hopper-feed the product is moved by conveyor belt thru a weighing-house, onto a second and smaller belt, and finally thru a chute to the ship.

Transfer facilities at Freeport are similar in efficiency to those at Galveston, but quite unlike in operation.* Here the specially prepared sulphur dock stands some 50 feet above mean low tide. An incline railway leading to this elevated position allows the loaded steel dump cars to discharge the sulphur into hoppers from which chutes carry the material directly into holds of the ships. The fact that ships may be entered, loaded, and cleared in one day suggests the efficiency of the method employed.

Cargoes of the sulphur reach various ports of the world. Besides the domestic shipments that supply our demands on the Atlantic and Pacific coasts large quantities are sent to each of several foreign countries, as Canada, Germany, France, and Australia, in all amounting approximately to 32 per cent of the production (Fig. 8).

A Typical Large-Scale Industry

Operations in the Gulf Coast sulphur fields are in every respect characteristic of large scale industry. One is impressed by the magnitude of plants, quality of managerial and labor forces, and quantity and regularity of production.

Huge buildings with smokestacks towering far above may be seen for miles across the level coastal plain, and are made much more conspicuous by the almost complete absence of other development (Fig. 2). Inside these structures are numerous large boilers which heat daily millions of gallons of water and compress similar volumes of air used in steaming the underground sulphur deposits as well as providing heat for all sulphur-transfer lines. The same buildings house electric generators that provide power for drilling, lighting, and to a very limited extent the movement of sulphur. Fuel demands have led to a pipe line extension from considerable distance in order to provide the plants with natural gas which has recently displaced fuel oil. Fuel costs for such a plant may reach $4,000 or $5,000 a day. No other expense save labor exceeds that of fuel.

*** Note: To prevent silting in the harbor at Freeport the Brazos River has been diverted some seven miles upstream, leaving the old channel as the port.**

The management and labor force are of comparatively high type. At the head of the business is a corps of efficient, well trained, and experienced executives and technical staff including mining, mechanical, and electrical engineers and chemists stationed in modernly equipped offices or overseeing the work in the field. Next in rank is a host of skilled white laborers, as carpenters and mechanics, who also demand high daily wages; and still further down the list a number of unskilled workmen performing the more menial tasks at a relatively lower wage. The companies take considerable interest in civic welfare, as is particularly to be noted at Gulf and Newgulf where the towns are all but completely dependent on the sulphur industry.

Thruout the period of active production the sulphur industry has experienced continuous and rapid growth (Fig. 8). While output in many of our minerals has tended to double each decade, that of sulphur has quadrupled in the last two decades. For each of the last several years production has approximated the 2,000,000-ton mark with little if any slackened work. Contrary to the too-oft expressed opinion concerning length of working-day and regularity of operations in the South, labor is on the eight-hour day basis and operations continue 24 hours a day, every day in the year. Contentment among the laborers is suggested by the complete absence of any organized troubles whatsoever. Under such conditions production has been pushed far ahead of sales. Ordinarily upwards of 2,000,000 tons are stored on the fields, enough to supply market demands for more than a year.

JUNIOR HIGH SCHOOL GEOGRAPHY*

DOUGLAS C. RIDGLEY
Clark University, Worcester, Massachusetts

The organization and development of departmental teaching in the upper grades of the eight-year elementary school about twenty-five years ago, led, a few years later, to the organization and development of a new administrative unit in the public school system known as the Junior High School. The Junior High School, in its complete organization, includes grades 7, 8, and 9, with a curriculum prepared to meet the needs of pupils of twelve to fifteen years of age, and with a corps of departmental teachers well prepared in training and in interest to do effective school work in these grades.

With the definite and extensive development of the Junior High School, the twelve-year public school program becomes divided into three parts: a six-year elementary school; a three-year junior high school; and a three-year senior high school.

Prior to the organization of the Junior High School, courses of study in the various subjects were developed as seemed best for an eight-year elementary school unit. No need existed from the administrative point of view for completing certain units of study at the end of the sixth year. With the development of the Junior High School as a distinct three-year unit, one of the most important problems offered for consideration was the proper articulation of the courses of study for all subjects between sixth grade and the Junior High School. If the administration and teaching in the Junior High School were to have the necessary freedom to meet the special purposes of the school, there must be freedom to organize and present the subject matter of geography, history, mathematics, science, and other studies in accordance with the guiding principles underlying the Junior High School.

In geography, the modification of the courses of study called for the completion of a well defined large unit of geographic study in sixth grade that should be suited to the needs and abilities of sixth grade pupils without leaving certain continuation topics for the Junior High School. In recent years, a tendency to meet this need is widely observable in courses of study and in textbooks.

* Presented before the Department of Grammar and Junior High Schools of the Maine Teachers' Association at Portland, Maine, October 25, 1929.

SOME TENDENCIES IN COURSES OF STUDY

The first tendency to lead to re-organization of seventh or eighth grade geography as a different kind of unit from the previous grades seems to have arisen from an influence not directly operative on curriculum making, but from an influence which has had a powerful indirect bearing on all educational thinking.

The opening of the World War in 1914 emphasized the fact that a knowledge of all parts of the world was necessary to appreciate the important events of the day. With the active participation of the United States in the World War in 1917, the need of understanding the rest of the world became imperative, and that need has been recognized continuously since, and is stressed in numerous educational meetings and in much educational literature.

The subject of geography is peculiarly well fitted to give the boys and girls of school age a sympathetic and friendly attitude of mind toward our world neighbors. Geography is largely concerned with interpreting the lives of people everywhere in relation to their surroundings and needs.

Immediately on the entrance of the United States into the World War, school superintendents and committees on courses of study sought the aid of geography in helping pupils of junior high school age to get the correct point of view of the United States in relation to the rest of the world. These first efforts to meet the need, resulted, in many cases, in devoting a portion of the last year in geography to a definite study of "The United States in Relation to the Other Nations of the World." This point of view, developed as a war measure, has grown, been modified, and expanded into the essential foundation, in many courses of study, of the seventh or eighth year's work in geography. The point of view has lost its belligerent significance of 1917 to 1919, and has developed into a promising survey of our international understandings as a means of obtaining and maintaining a permanent world peace.

In order to make place for this world view of our national interests as interpreted by geography, it became necessary to make adjustments in the courses of study in geography. This need of adjustment was closely related also to the needs of the developing Junior High School. In seeking these means of adjustment and in seeking improvement in geography teaching, there has been evolved the "one-cycle plan" of geography courses. This means that the pupils are required to study the same geographic re-

gion only once from the same point of view. Thus the last year, or, in some cases, the last two years of geography courses, a geographic treatment of the world is given from a wholly different point of view in harmony with the pupils' advancement in years, interests, and abilities.

In developing the "one-cycle plan" in geography courses, due attention has been given to the articulation of the geography work between sixth grade and Junior High School.

Courses of study in geography which make definite provision for this articulation commonly treat the following large units by grades.

Third Grade—Home Geography
Fourth Grade—World Geography
Fifth Grade—Western Hemisphere
Sixth Grade—Eastern Hemisphere
Seventh Grade—Junior High School Geography
Eighth Grade—Junior High School Geography.

There is a general harmony in the nature of the subject matter and method in the third, fourth, fifth, and sixth grades of the elementary school. Numerous schools are developing valuable individual courses in the Junior High School. The fundamental consideration in the Junior High School courses is the point of view already mentioned, namely, the pupils should know the United States in relation to the rest of the world as it can be set forth in geography. This plan is definitely provided for in the recently published course of study for New York State, for New York City, and for other states and cities.

Recent new series of geography textbooks have been prepared on the "one-cycle plan" for geography. This movement is leading to the publication of textbooks in which each number of the series is a volume suited to one year of geography work, each volume complete in itself, dealing with a large geographic unit without duplicating the treatment of any other volume of the series. These series contain, as a rule, four volumes or five volumes, suitable for geography work in grades 4 to 7, inclusive, or 4 to 8, inclusive. Authors and publishers of geography textbooks are setting new standards for the treatment of geography as one of the most valuable subjects in the first year of the Junior High School to be continued in the second year, if possible. These recent series of geography textbooks have taken into account the needs of the Junior High School both as an administrative and a teaching unit.

GEOGRAPHIC AND ETHNIC GROUPING OF ARIZONA INDIANS*

J. W. HOOVER
Arizona State Teachers College at Tempe

The state of Arizona offers a splendid opportunity for comparison of the influence of ethnic origin with that of natural environment in determining traits and characters of Indian population. Several distinct physiographic and climatic provinces are represented with important subdivisions. The area is also exceptional in the number of distinct native stocks occupying it.

As an Indian state, Arizona may well claim first rank. Of the 345,000 Indians in the United States, as enumerated by the Indian Service Bureau, 121,000 are in Oklahoma, with only 46,000 in Arizona. But whereas Oklahoma's Indian population[1] is only 29 per cent pure, that of Arizona is 99 per cent pure, giving the state first rank in pure blooded Indians. New Mexico ranks third in both full-blooded and in total Indian population.[2] Furthermore, Arizona includes the largest areas given over entirely to Indian use, and in these there has been a minimum of interference with Indian customs and traditions due to influence or contact with whites. In no other state do so many Indians occupy essentially the same areas which their forbears occupied before the coming of the whites; so we find the Indian population of the state distributed today much as it was prior to white settlement. The present day reservations are representative of these areas somewhat constricted, especially in the case of the hostile mountain peoples.

The lands in which were found most of the Indian settlements were least desirable from the white man's standpoint. But hostilities between tribes rendered such areas as the deserts of Southern Arizona, the mountains of Central Arizona, and the mesas and canyons of Northern Arizona, desirable to the Indians because of

* Mr. Hoover has written extensively on the Arizona Indian and the following articles by him will be of special interest to readers desiring to follow the subject in greater detail. (1) The Indian Country of Southwestern Arizona, *Geog. Rev.*, Vol. 19, p. 38. (2) Tusayan, the Hopi Country of Arizona, *Geog. Rev.*, Vol. 20, p. 425; (3) Modern Canyon Dwellers of Arizona, *Jour. Geog.*, Vol. 28, p. 270. Editor.

[1] Includes all persons with recognizable Indian blood and also non-Indians entitled to enrollment.

[2] Reports of the Secretary of the Interior relating to the Bureau of Indian Affairs, 1927 and 1929.

their relative security. On the other hand the white settlements tended to follow the easy lines of communication, or were located with reference to resources which were unavailable to the Indians; hence tended to develop on a pattern suggestive of the neutral zones between Indian tribes. Only the Pimas, Yumas, Mojaves, and several other minor tribes, held agricultural lands desirable to the white man on the flood plains of the Gila and Colorado rivers. Because of their concentrated numbers, and their friendly relations with the white settlers, who came to Arizona rather late, these people were able to maintain a hold upon their lands. Only the barren wastes immediately to the east of the Colorado River have been shunned by both Indian and white.

FIG. 1. Vamori, a Papago Farm Village on the Open Plain.

GEOGRAPHIC CLASSIFICATION OF ARIZONA INDIANS

The Indians of Arizona may be geographically designated as (1) Oasis or Flood-plain Dwellers, (2) Desert Dwellers, (3) Mountain Valley Dwellers, (4) Plateau Dwellers, and (5) Canyon Dwellers.

The first two designations are suggestive of major features of the Basin Range Physiographic Province of southwestern Arizona, in which these people dwell. The Mountain Valley Dwellers occupy the Mountain Province which extends across the state from southeast to northwest. Plateau, Mesa, and Canyon Dwellers, occupy parts of the Northern Plateaus Province in which the suggested features respectively predominate.

ETHNIC GROUPING OF ARIZONA INDIANS

The distribution of ethnic stocks shows little or no correlation with natural regions or with the above geographic grouping; altho tribes of the same stock have spread somewhat in accordance with drainage areas. At least four important stocks are represented among the Arizona Indian tribes, as follows:

(1) The Piman stock includes the Pimas and Papagos who occupy the lands tributary to and south of the Lower Gila. A third branch of the Pima family, the Sobaipurai, formerly occupied the Santa Cruz Valley from Tucson south. After being Christianized by the Spaniards, they were driven out by the Apaches, and their remnants were absorbed among the Pimas. It was for these people that the San Xavier mission, near Tucson, was established, and the present Papago village was settled at a later date.

(2) The Navajos and Apaches are both generally conceded to be Athapascan stock. Neither group cares to acknowledge such relationship, but they have in common, physical characteristics, seminomadism, predatory tendencies, and similarities in language and

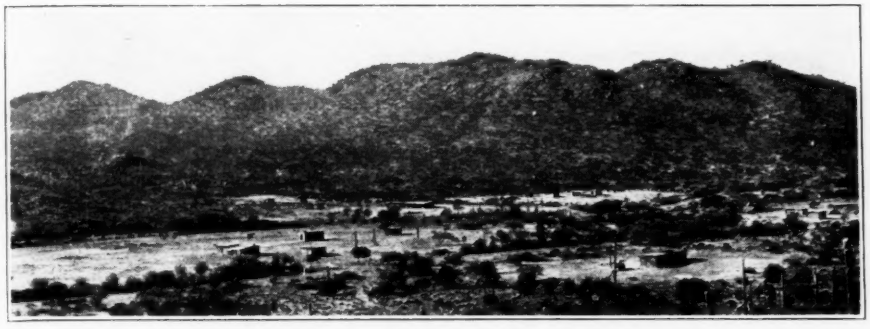

FIG. 2. Santa Cruz, a Papago Mountain Village.

customs. The Apaches occupy the mountain region of Southeastern Arizona and the Navajos the plateaus to the north, extending into northwestern New Mexico. All these peoples are physically differentiated from the lowland peoples by their lithe and wiry build, with longer faces and higher cheek bones, in which they conform to the popular concept of the American Indian.

(3) The Yuman stock has scattered most widely. As indicated by language and certain traditions and customs which in their nature are most persistent, the Yuman stock includes the Mojaves, Haulpais, Havasupais, Aravapais or Mojave Apaches, and the Maricopas. They seem to have spread northward along the Colorado River and eastward into the mountains of central Arizona. The Yuma and Mojave Apaches, or Yavapais, have frequently been confused with the true Apaches because of their mountain environment, their manners of living, and their common hostility. Their blood kinship is with the Mojave, and not with the Apache. Yuma

or Mojave indicates their kinship; Apache their character. The Maricopas are another small branch of the Yuman stock who withdrew, or were exiled to the east early in the 19th century, and have found a home with the Pimas whom they have come to resemble except in disposal of their dead.

(4) The Pueblo Indians who are represented by the Hopis, include several distinct stocks in Arizona. The language of the Hopis suggests Shoshonean origin, but they seem to be a composite people, coming from different quarters, and welded together by hostile neighbors in common, seeking the protection of the mesas. One of their pueblos, Hano or Tewa, is peopled by Indians from the Tewa

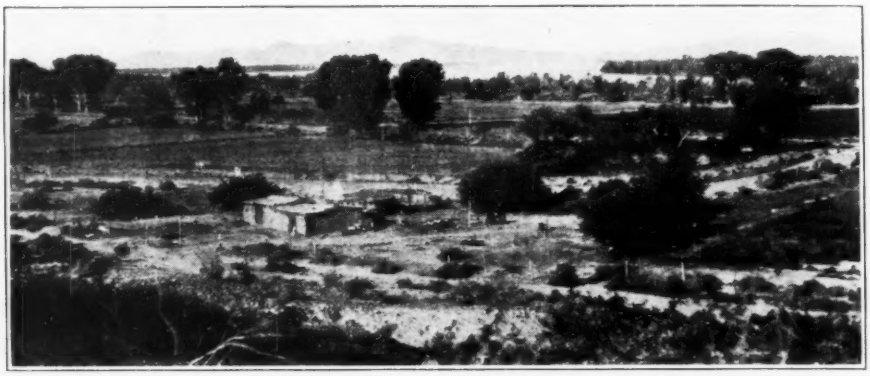

FIG. 3. Mojave Indian farm lands and settlements on the Flood Plain of the Colorado River near Parker.

people of the Rio Grande. The New Mexico pueblos include three independent stocks, Tewan, Keresan, and Zuni.

(5) On the borders of the state, just beyond its confines, are several small tribes of Shoshonean stock, including the Chemehuevis on the California side of the Colorado River in the midst of the Yuman peoples, and sharing many of their ways; the Piutes north of the Grand Canyon, and along the San Juan in southern Utah; and the Utes of Southwestern Colorado.

THE DESERT AND OASIS DWELLERS

As Oasis dwellers, the Pima Indians and the small Maricopa tribe have to the present occupied the easily watered lands on the flood plains of the Gila and Salt rivers. In the same manner the narrow flood plains of the Colorado have been occupied by the Mojave, Yuma, and Chemhuevi tribes. The Cocopah tribe occupied

the delta of the Colorado and is found chiefly in Mexico, with a few families in Arizona south of Yuma. At present the Pimas number close to 5,500; the Yumas, now all on the California side of the river, about 870; the Mojaves close to 1,000, nearly one-half of whom are on the California side, mostly at Needles; a little over 100 of the Chemhuevi on the California side; and the Cocopahs number nearly 800 in Mexico. The arid to semi-arid area south of the Gila River and extending into Sonora, Mexico, is occupied by the Papagos, numbering about 5,500.

FIG. 4. Navajo Hogan, mother and child.

Geographic conditions seem to have been more far reaching in determining many characteristics of the Indian tribes than has ethnic origin. In the case of the Pimas and Papagos, altho closely related ethnically as well as geographically, differences of geographic environment have produced some apparent differences in character. The Pimas occupied the flats along the Gila River and later the Salt River, and became definitely settled as an agricultural people, and required for their support only a small fraction of the amount of area required by the same number of Papagos on the desert to the south. The Gila River guaranteed a constant supply of water which was easily diverted onto their fields on the flood plains. With fairly certain crops they failed to provide for lean

years as did their neighbors to the south who led a more precarious existence. The Papago desert dwellers are today largely stockmen, and secondarily dry farmers. Before the coming of the Spanish padres who introduced the stock, they supplemented the products of their fields with limited game. They were dependent for their field crops upon the concentration of surface run off in favorable sites along or at the debouches of washes. Permanent water supply for domestic purposes was to be found only around the mountains and necessitated seasonal migration between the mountain villages and the distant fields. Hence the Papagos are more industrious and are preferred as laborers to the Pimas, who are also less ready to seek remunerative employment. Even physically they have become somewhat differentiated, as the Papago tends to better form, greater energy and endurance. The tendency to obesity, particularly noticeable among the Pimas, is also characteristic of the other flood plain dwellers, as the Maricopas, Yumas, and Mojaves, regardless of stock, and is due to the large place which the mesquite bean plays in their diet. The mesquite requires a supply of ground water, and hence grows extensively over these parts of the river flats not under cultivation.

The Indians on the flats of the Colorado River farmed much like the Pimas, but the Colorado River, more dependable than even the Gila, like the Nile, kindly flooded parts of its plain annually; and these Indians annually planted their corn, beans, and squash in the river ooze as the spring floods ebbed. They were able also to supplement their diet with fish from the river.

All the desert and oasis dwellers were village dwellers, having had to concentrate their settlements for greater security against their marauding mountain neighbors. The Pimas were situated on the northern border of Pimeria, and were especially exposed, being compelled to concentrate and occupy only a portion of their irrigable lands. The Mojaves maintained a regular line of pickets to guard against raids.[3] Since peace and security has been guaranteed, the villages are tending to disintegrate. The Papagos are splitting up into a greater number of smaller settlements, and the Pimas are leaving their villages to live on their government allotments as the Yumas and Mojaves have already done.

The same forms of housing also were common to all the desert and oasis peoples, and distinct from all others; so that travelers

[3] Lieutenant E. D. Tuttle, *Arizona History Review*, Vol. 1, July, 1928, p. 59.

have always remarked upon the similarities of Pimas and Maricopas, as well as the several Colorado River tribes. The type of house in common use has been of wattles, plastered with mud upon a framework of uprights and poles. This was preceded by the primitive "ki" built of poles laid radially, bent together at the top and covered with earth, so as to resemble an overturned wash basin. It was used mainly for sleeping quarters, while the usual living quarters were under the outdoor arbor which still persists. Among the Pimas and Papagos the wattle hut is giving way to adobe

FIG. 5. Terraced gardens below the spring at the Hopi village at Bacabi. Hopi Indian Reservation.

construction, and most of the Colorado River Indians have been induced to move into government built frame houses which add not an iota to the degree of their civilization nor to their health.[4]

All these lowland peoples, having fixed abodes, were peaceful Indians, and have always been independent and self-supporting. The Pimas, Papagos, and Maricopas are noted for their friendly record, never having shed white blood in combat. The record of the Colorado River Indians has likewise been peaceful, except for several minor infractions due to misunderstandings. Altho peaceably inclined, all the oasis peoples were ready to defend their homes

[4] For details concerning the shelters of Arizona Indians see Goddard: Indians of the Southwest, American Museum.

with bravery. Hence the early attempts of the Spaniards to plant a colony among the Yumas, appropriating some of their best lands, led to a revolt in which the Spaniards were driven out. Later, first Americans encountered suspicion and hostility at the outset, but peace once established remained unbroken. The Mojaves likewise at first were inclined to be suspicious and bellicose, but after a single combat entered into a permanent peace. The Cocopahs, on the delta of the Colorado River were peaceable and friendly from the first, in striking contrast to their mountain kinsmen of the Cocopah Mountains in Lower California who were described as "a wild, savage, and blood-thirsty race."[5]

The Chemehuevis roved over the surrounding country to a greater extent than the other tribes along the Colorado, thus retaining something of their early modes of life common to Shoshonean peoples. Also their valley is the narrowest and bordered by rugged mountains. The Pimas were always allies of the whites thru the turbulent periods of Arizona history immortalized by the Apache wars, and in their villages the pioneers en route across southwestern Arizona found safety and replenished supplies.

Several villages of Yaqui Indians are located on the Salt River oasis and near Tucson. The major portion of the Yaquis inhabit inhospitable rugged areas in the south in Mexico and even within the last several years have been at open warfare with the Mexican government. In the hospitable environment of the Arizona oasis these same people are the most efficient and trustworthy of workmen and their villages closely resemble those of their Pima and Papago neighbors.

In religion the Pimas reflect their closer contact with white civilization and are certainly the most Christianized tribe of Arizona Indians with Presbyterianism predominent. The Papagos being most isolated still retain the religion brought by the Spanish padres, but most of them mix with it ancient Pagan rites. The tribes of Yuman stock are all quite resistant to Christianization and tenacious of their Pagan customs, especially the burying of their dead.

THE MOUNTAIN VALLEY DWELLERS

The Mountain Valley Dwellers occupied the mountain belt of southeastern and central Arizona. The name Apache has been quite generally applied to all peoples of the mountain provinces;

[5] Hiram C. Hodge, *Arizona as It Is*, or *The Coming Country*, pp. 157-158. Boston, 1877.

the word no doubt originating from the Zuni word for enemy,[6] as they were commonly regarded because of their depredations. The Yavapais, Yumas or Mojave Apaches who lived in the central mountain region tributary to the Bradshaw Mountains, shared with the true Apaches, not only their mountain environment, but many traits developed by it. All depended in part upon raids for their subsistence and were the terror of the peace loving plains tribes and later of the white settlers, and have been frequently described as the most treacherous and bloodthirsty of American Indians. In this the Yavapais of Yuman stock were completely at variance with their peaceable settled kinsmen along the Colorado. All lived in the narrow mountain valleys and practised a little primitive agriculture, producing the usual Indian crops of corn, beans, squash, and melons. Their food supply was augmented by mesquite beans, mescal and the fruits of the cactus which grew in the lower valleys and by pinon nuts which grew on the mountains. Their mountain environment further prevented even those of common language, consanguinity, and adjacent territory from achieving any sort of permanent unity. The Apache war tribes were never all on the war path at once and often fought each other.

The major groups of the Apaches are in accordance with well differentiated subdivisions of the Mountain Province, as the Tonto Basin, the White Mountains and the wider mountains and valleys to the south of the Upper Gila. As the government found it cheaper to feed these people than to fight them, they were restricted to reservation areas; the Yavapais along the Verde River and the Apaches in the White Mountain region and in the Upper Gila Valley. Those in the valley have become largely agricultural and self-reliant, while those in the mountains, depending chiefly upon cattle, have degenerated. All the mountain peoples live in similar huts or rounded wick-i-ups, but the Yavapais adhere to the Yuman custom of burning their dead, while the Apaches like their Navajo kinsmen, put away their dead in out of the way places which are afterwards avoided.

THE PLATEAU DWELLERS

The Plateau Dwellers, represented by the Navajos, Hualpais, and Piutes, represent three distinct stocks. These people have de-

[6] J. C. McClintock, *Arizona the Youngest State.* (3 volumes, Chicago, 1916) Vol. 1, p. 28.

veloped traits more characteristic of the plains Indians. Originally nomadic hunters, later they became primarily pastoral and semi-nomadic. Like the mountain peoples they raided neighboring settled agricultural tribes and later had to be chastened by the United States Army. The Navajos are the most numerous Indian tribe in the United States and are increasing. They are entirely self-supporting, depending upon the grazing of sheep and goats, and the weaving of the famous Navajo blankets. The Haulpais and Piutes on the other hand[7] have decreased and many of them have scattered among the white settlements. The Hualpais graze cattle rather than sheep.

FIG. 6. Apache Village on the San Carlos Indian Reservation.

THE MESA DWELLERS

The term Mesa Dwellers is here applied to the Hopi Indians who have perched their picturesque pueblos on top of the fingerlike projections from the Black Mesa in the midst of the Navajo Country. Like the Pueblo Indians of New Mexico, they build compact and terraced permanent villages, and are primarily agricultural. As settled village dwellers they are more friendly than their semi-nomadic Navajo neighbors. In culture they are a remnant of the pueblo cultures which in prehistoric time extended southward over the Gila watershed and northward into Utah. They are skilled in dry farming and their peculiar methods are ideally adapted to the severe climatic limitations of their area, which are low rainfall and short growing season. Their fields are necessarily located along the washes where they are flooded after heavy summer rains or where there is some-sub-drainage. Their villages on the other hand are located on top of the mesas which extend

[7] Locally a limited amount of agriculture is practised by them after the manner of the Hopis whom they have imitated.

between the washes and are at varying distances up to fifteen miles from their fields.

The shrinkage of the Pueblo cultures in the Southwest may have been due in part to natural causes, such as decreased rainfall, but more likely to depletion of timber in critical marginal areas, with consequent reduction of available moisture because of more rapid runoff, and deepening of erosion channels. The Hopi fields are being reduced in area thru the same processes and deep, narrow arroyos carrying the water which formerly spread over the fields after rains, and lowering the sub-drainage below the reach of field

FIG. 7. Apache Camp and "Wick-i-up" on the White River, White Mountain Region.

crops. Even more important may have been the entrance into the area of the nomadic tribes of lower culture who raided their fields and rendered their mode of life increasingly precarious. With the Hopis, the coming of the Spaniards, their resistance to them, and fear of reprisal, drove them finally up on top of the mesas.

THE CANYON DWELLERS

The Canyon Dwellers are today only the small remnant of the Havasupai or Supai tribe who live in the depths of Cataract Canyon.[6] Formerly when more numerous, they are believed to have extended their settlements into suitable locations in the Grand Canyon as at Indian Gardens on the Bright Angel trail. Prehis-

[6] A south branch of the Grand Canyon.

toric ruins of the Pueblo cultures are especially numerous in the deep cliff walled canyons of the San Juan River and its branches in the Navajo Country of Arizona, in southern Utah and southwestern Colorado. But contemporaneous ruins of the same culture are found in the same areas on the mesa tops and in the open country so that they were by no means exclusively canyon dwellers. These prehistoric peoples tilled small easily watered areas on the floors of the canyons as the Supais do today. Their dwellings and villages were quite frequently in large recesses, shelters or caves in the canyon walls where they could be more easily protected. The Supai Indians also formerly depended upon smaller cliff-dwellings in the walls of their canyon as safety retreats in case of Navajo or Apache raids, or from the rigors of winter.[8]

The Supais are agricultural, growing much fine fruit and vegetables. They are accordingly settled and have always been peacefully inclined like the agricultural peoples elsewhere. In manners of housing they are similar to their Plateau neighbors.

CONCLUSION

The Indian tribes of Arizona may be advantageously grouped in accordance with their distribution in natural provinces or subprovinces, as geographic conditions are far reaching in determining differentiating characteristics.

Certain differentiating characteristics are persistent in the face of different or changing geographic environment and are indicative of stock or ethnic origin. Such are somatic characters, language, and customs rooted in tradition and religious beliefs, as for example, the manner of disposal of the dead. On the other hand geographic conditions are predominant in determining the economic life or manner of making a living, character of food, clothing, and housing; inclination to war or peace, disposition to nomadism or settled life, scattered or village settlements.

Types and degrees of culture, including arts and crafts, are somewhat contagious and may vary widely in areas which are similar geographically. Many cultural traits are thus the result of chance contacts and are favored by accessibility, while isolation, as of mountain peoples, operates negatively.

[8] Earl Y. Henderson, *The Harasupai Indian Reservation* (Pamphlet), pp. 7-8. 1928. Office of Indian Affairs, Dept. of the Interior.

ORGANIZATION OF A UNIT IN MATHEMATICAL GEOGRAPHY

KATHERYNE COLVIN THOMAS
State Teachers College at Buffalo

The organization of a unit in mathematical geography which is presented here is an attempt to meet the problem of individual differences among students in a required geography course in a teachers college. The problem of individual differences due to varying degrees of intelligence, preparation, interest, and other varying conditions under which students work, which is encountered by all teachers, confronts with particular force those who instruct large classes in required courses.

The course for which this unit was organized is an elementary college course in the principles of geography of the type required in the freshman year of students in many normal schools and teachers colleges. It meets three hours a week for a semester, and since it is the only required content course in geography, it is crowded with subject matter. The topic of mathematical geography is allotted about three weeks.

The organization followed is not original with the author, but is suggested by the work of many others, especially by Morrison in "The Practice of Teaching in the Secondary School." Briefly, the plan consists of a preliminary test, the selection of the advanced students, the presentation of subject matter, a second test, re-teaching, a period of application and assimilation, and a final test. An outline of this procedure with references and study suggestions is given the students at the beginning of the work.

THE PRE-TEST

The exploratory test is given to determine for the instructor the exact teaching situation. It shows him the group median and the range within the group. It serves, moreover, the important function of indicating for each student where he stands at the beginning of the unit.

The test used is objective, the questions for the most part of the multiple choice type. It includes, in addition, an exercise involving the interpretation of a diagram and a map-reading exercise. Five typical questions follow.

1. The earth is about (a) 9,300 (b) 93,000 (c) 93,000,000 (d) 930,000,000 miles away from the sun. 1( )

2. The earth is nearest the sun during (a) spring (b) winter (c) fall (d) summer. 2( )

3. At Montreal the noon shadows always fall (a) north (b) south (c) directly beneath objects. 3( )

4. The circle of illumination always bisects the (a) tropic of Cancer (b) tropic of Capricorn (c) equator. 4( )

5. There is a difference in time of one hour for every (a) 15° of latitude (b) 15° of longitude (c) 45° of latitude (d) 45° of longitude. 5( )

The test, in experimental stage for several years, has been given in its present form to two groups of students, each numbering about one hundred and twenty-five, and each divided into four sections. A perfect score for the test is 100. In both groups the median score was 51. In both groups the range was from a score in the 20's to 91. This range, from almost complete ignorance of the subject on one hand to almost complete mastery on the other, indicates clearly the problem of efficient instruction.

THE PRIVILEGED GROUP

From the results of the first test a selection is made of students who show that they need comparatively little work on the subject. This group is made up chiefly of those students who have had physical geography in high school, but it includes some who have not studied geography since the elementary school. Personal interviews with the latter reveal interesting reasons for their knowledge. One student said that he couldn't see why anyone wouldn't know the answers to the questions. Another gave as the reason the fact that her sister teaches physical geography. Still another insisted that she had "guessed," but upon further questioning showed that her "guessing" had been intelligent reasoning.

So far, no standard has been set which must be met before admission into the privileged group is granted. The instructor decides after examining the results of the pre-test which students will be placed in the upper group. It usually includes from 5 to 10 per cent of the entire group.

The students placed in the advanced group are expected to analyze the results of their tests to find which topics give them the

greatest trouble and are made responsible for reviewing that part of the subject matter. They are given the privilege of attending class or not as they choose and of working on special problems for special credit. The problems given this group vary from time to time, but some familiar ones are repeated frequently.

1. If the earth moved about the sun with its axis perpendicular to the plane of its orbit, would you care to live in Buffalo? What would be the conditions of temperature thru the year? What would be the length of day and night? Would the crops raised in the region be the same as at present?

2. Commander Byrd has added new bays and mountains to the map of Antarctica. How does he know where to place these discoveries on his map?

3. Tell the story of the sun's apparent behavior during the year at Quito, Ecuador. Have the class imagine that it is in Quito and describe, as if there, the path of the sun thru the sky.

Each member of the privileged group prepares two of the problems. Certain students are chosen to present their problems orally. If these students maintain their high standing on the tests and complete their problems satisfactorily, they are given the grade of "A," which means superior work. One of the difficulties in carrying out this plan of work is that of holding these students to a high standard. Not infrequently students who rank high in factual tests find it difficult to apply their information in the solution and presentation of a problem.

In this way, the students who, already familiar with the subject, might sit in class a bit bored and a disturbing element to the teacher who feels that every member of a class should be challenged to an effort, are encouraged to further development. They usually attend class voluntarily and, watching for points they need, they remain alert and interested. Not infrequently they are able to lend a helping hand to the students who are swamped by new material.

PRESENTATION OF SUBJECT MATTER

The presentation of the subject matter may be by assignment and recitation, by laboratory exercises, or by lecture and demonstration. Any of these methods might be fitted into this general plan. The author follows the last plan with supplementary assignments and exercises.

THE SECOND TEST

This test enables the instructor and the students to see progress and to find points that need further emphasis. The checking of frequency of error shows definitely the topics upon which the group needs drill. A second purpose is to indicate those students who by intelligent application have already mastered the subject and who are now ready to join the privileged group in work on special problems for "A" credit.

The test given is the same as the preliminary test, that test being of sufficient difficulty to show a spread within the class even after the presentation of the subject matter. The most striking features of the results of this test are the narrowing of the range within the group and the remarkable improvement made by some students. On one such test, a student raised her score from twenty-two on the pre-test to ninety-six on the second test.

RE-TEACHING

Each section, narrowed down to the slow and, it must be admitted, the lazy, is small enough for informal discussion and for considerable drill. The slow student can ask questions without fear of taking too much class time and attention. Ideally, this part of the unit should continue until all arrive at mastery. Practically, under most conditions, this is impossible.

APPLICATION AND ASSIMILATION

When the class meets again as a whole, the members of the privileged group present the results of the problems upon which they have been working. Application of the subject to points of current interest is made.

THE FINAL TEST

In order that a spread may be obtained, the final test is more difficult than the pre-test. The most difficult of the multiple choice questions are retained; a number of completion questions are added; a diagram is given to be completed; a new map reading exercise is substituted for the old.

The unit cannot be called finished without analysis of group and individual results. The instructor is interested, for example, in the rise of the group median from 51 on the pre-test to 82 on the

final test and in the narrowing of the range of 27 to 91 on the pre-test to a range of 63 to 99 on the final test. Without control groups the results do not prove the superiority of this method of organization over other methods as far as group accomplishment is concerned, and since it was for the purpose of caring for individual differences in preparation and interest that this method was developed, the instructor is more interested in individual records.

In the group for which results were given above, the members of the privileged group all raised their scores to above ninety on the second test and maintained them there on the final test in addition to their work on the special problems. Of the lowest quartile on the pre-test, 30 per cent climbed to scores above the median in the final test. Of these, two were in the upper quartile in the final test. These records, combined with observation of student reactions, serve to convince that both these groups benefit from the method described.

CONCLUSIONS

To the instructor, this unit of work brings satisfaction because it stimulates the advanced students toward further effort while at the same time it provides for the beginning student, and because it increases the efficiency of instruction by enabling the teacher to be in touch with the teaching situation from start to finish. To the student, this unit of work brings satisfaction because it is definite in aim, in procedure, and in results.

KASHMIR AND ITS PEOPLE

R. C. MALHOTRA
St. Mary's College, St. Marys, Kansas

INTRODUCTION

The geography of Kashmir, Tibet, and Afghanistan is little known among most American students and teachers largely because but little satisfactory information on these regions appears in the average geography text. Among the several reasons accounting for this dearth of information is the fact that no traveler from Europe or America is permitted legally in Tibet, and only a few visit Afghanistan. Those who enter cannot travel outside the capital city, unless connected with the industrial and educational development of the country. Kashmir is, however, open to travelers but only a few visit it because of language handicaps, its inland location, and mountainous surface. The geographical aspects of these countries, particularly those which affect the inhabitants and their occupations, are neglected in most textbooks. It is hoped that the material presented here may awaken an interest in Kashmir.

LOCATION AND BOUNDARY

Kashmir lies between 32° and 37° E. and 73° and 80° N. and is situated in the extreme northwest of India. In shape it is roughly a square with an area of 84,432 square miles. It is bordered by Turkestan on the North, Tibet on the east, the Punjab on the south and the North West Frontier Province on the west. Kashmir holds an important position in relation to India because the northwestern boundary of the state has a number of mountain passes to surrounding territory.

PHYSICAL ASPECTS

Physically Kashmir may be divided into three regions, viz., trans-Himalaya, Himalaya proper, and lower Himalaya. The first lies in the extreme northern part of the state, is almost entirely mountainous, and is more than 12,000 feet above sea-level. The second with an elevation exceeding 5,000 feet, surrounds Kashmir valley, one of the most beautiful regions of the world. Lower Himalaya comprises small mountain ranges, and valleys with fertile and level land in the southern part.

Several rivers flow thru the entire length of the state. They and their tributaries are, for the most part, used for the transportation of timber, and for irrigation, hydroelectric purposes, fishing and other industrial uses. There are five lakes, all used for fishing.

Lake Dal in Kashmir Valley presents a unique feature of study to naturalists, geographers, and ecologists, on account of its float-

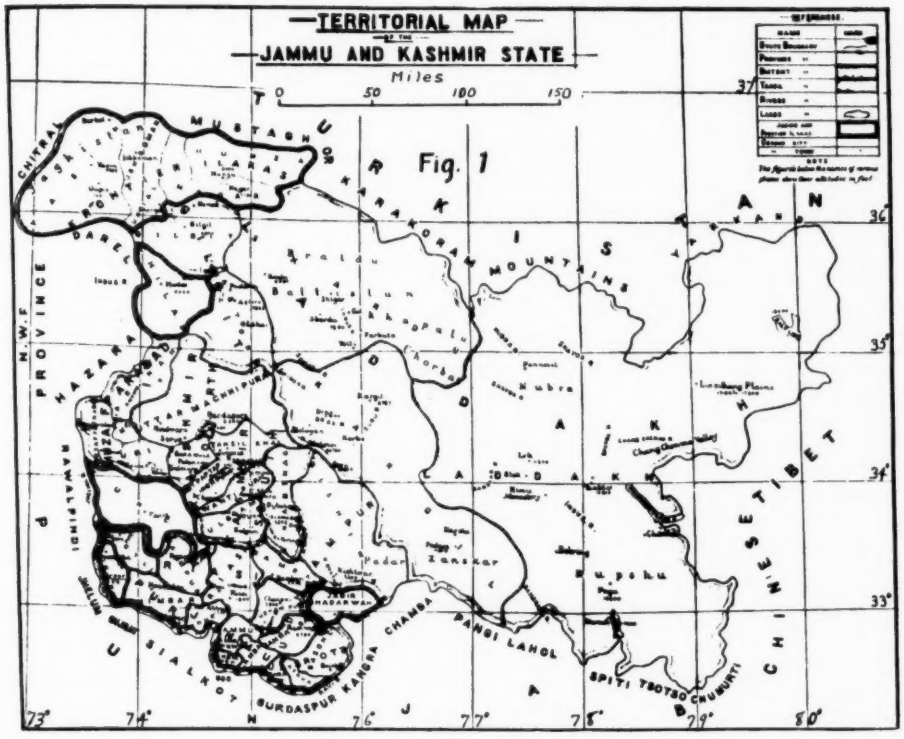

FIG. 1.

ing gardens. They are built on long logs and strips of lake reed, which are moored at the four corners by heavy poles driven into the lake bed. Heaps of weeds and mud are then formed into small cones. By means of capillarity, water of the lake irrigates the cones, which produce all types of vegetables. Due to scarcity of land within the radius of Srinagar, the capital, these floating gardens are the main source of vegetables.

Owing to the high altitude, and to the many snow covered mountains and forests, the temperature of Kashmir is never very hot.

Winters are very cold. The higher altitudes are extremely dry and cold in winter and pleasant in summer; intermediate altitudes are cold in winter and moderate in summer, and the lower lands are moderate both in summer and winter, while the extreme southern portion is warm and dry.

It appears to be a common impression in America that the whole of India is hot and that the people all have dark skin. This generalization has to be limited, not only with reference to Kashmir but to all the Himalayan territory stretching from the Punjab to Nepal and Bhutan. Such a climate as these localities offer has a tremendous influence on the physique, color, and occupations of the population.

POPULATION, RACE, AND LANGUAGE

On account of the dominance of forests, the state is thinly populated. The bulk of the population is agricultural. Many industries such as silk, wool, wood engraving, mining, shawl weaving, furniture making, are very prominent. In trans-Himalaya, rainfall being scarce, the population is extremely sparse and dependent on the pasture lands. There seems to be a tendency for immigration of new settlers but only selective groups of settlers are encouraged. This administrative policy seems to be sound, its object being that racial purity and a homogenous population may be achieved in due course of time.

Racially most of the population is of pure Caucasian (Aryan) stock. A traveler, coming from Europe or America and passing thru the rest of India, is impressed by the structural and anthropological differences of an average man of Kashmir. He is tall, has a fair complexion (not dark), blue, hazel, or dark eyes, is blond, brunet, sometimes red haired, and has a long face typical of Caucasians, long hair on the face, long head, prominent, narrow, long nose and general well-built structure. There are three reasons to account for the purity of Aryan stock.

1. Among the early Aryans, who migrated from Central Asia to India (out of the same group as their Caucasian brethren, who migrated to Europe), some colonized Kashmir. They did not have to compete with or marry the native population like those who moved southward; hence the original Aryan stock married within its own groups for generations.

2. During the Mohammedan administration Kashmir was never

fully controlled altho it was considered their territory. Due to the mountainous nature of the country, Mogul emperors made Srinagar their summer capital for a short time. Thousands of Aryans were converted to Mohammedanism, but they never allowed intermarriage. In features and complexion such converted population is similar to the Hindus of the state. The Caste system, modified as it is under centuries of transition and defective as it may seem, has tended to preserve considerable purity and the old Caucasian heritage to the Aryan race of Kashmir.

FIG. 2. An average man from Kashmir in Western dress. Note the features and race type.

3. Poor transportation facilities (at least in the past) have compelled the population to marry within the state. While it is generally true that hybridization tends to produce a stronger race and to impart the finer qualities of the better races, whereas pure selection weakens the race in this respect, there are conditions (such as when a race is better than the surrounding stock in qualities) when it is safer to marry within the race. Such an attitude is maintained by Aryans even today.

It is difficult for Americans to realize that Hindus from Kashmir cannot be distinguished from Europeans, when they are in western dress. This misconception is due to their habit of classifying all Indian people as dark skinned. In fact many Hindus are decidedly fair. Most of the Hindu population is in the southern portion of the country.

There are two languages, Kashmir and Dogri. However, they are really not two separate and distinct languages but are different dialects of the same language. The source of both is Sanskrit, which has developed there for centuries. The first books on medical

science (diagnoses and materia medica), drama, and astronomy, were written in Kashmir. Even up to this day Kashmir is one of the two biggest centers of Sanskrit research and education.

ADMINISTRATION

The territory is governed by an hereditary Hindu ruling family. Kashmir proper was conquered from the Afghans in 1819 by His Majesty, Ranjit Singh of the Punjab. His Highness Maharajah Gulab Singh occupied it in 1820 and conquered and annexed the Tibetan Province of Laddakh. His Highness Maharajah Gulab Singh Ji was succeeded by his son, His Highness Maharajah Ranbir Singh Ji. On his death, His Highness Maharajah Sir Partap Singh Ji, one of the eldest sons, governed the state up to his death. The present ruler, His Highness Sri Hari Singh Ji Sahib, completed both military and civil training in modern colleges, including some in Europe.

There is an administrative board which is composed of several ministers (like secretaries of the presidential cabinet of the United States). Each minister is in charge of several departments, which are run by a director or chief. The ministers are subordinate to the Prime Minister.

Politically the country is divided into provinces, each province into districts, a district into tahsil and sub-tahsil (similar to a county in the United States). The boundary of the tahsil does not depend on the area so much as on the population. The village is an important part of the administration system, particularly with reference to land, community welfare, police, forestry, land settlement, fishery, and matters of public interest.

The state maintains a cooperative department and has, for the farmer's benefit, what is probably one of the best state banking systems in India. Thru its effective operation the farmer is saved from the payment of a high rate of interest and from the possible dishonesty of the private banker. The land cannot be sold to the bankers but to the farmers only. In this manner the farming community which is the very backbone of the country is not sacrificed.

CROPS AND INDUSTRIES

All the fruits and vegetables of temperate climates such as the apple, pear, peach, plum, apricot, cherry, walnut and almond are grown in Kashmir valley. India imports most of its apples for

home consumption from Kashmir. The writer recalls seeing Kashmir apples, Rome Beauty variety, at Rangoon, a distance of more than 3,500 miles from Srinagar. In the southern part tropical and subtropical fruits are grown. Rice, wheat, maize, buckwheat, and millet are the main crops. Saffron (crocus sativus) is famous for its bouquet and its cultivation is an ancient industry. There is an urgent need for scientific agriculture as the soils are being depleted.

There are extensive forests which not only supply timber for export but also produce some fine wood for carving, which is a thriving industry. The forests are rich in drug producing plants, in game, and wild fruit, and they contain many health resorts. Sealing wax, bamboo, resin, and several other forest products are exported. There are many pasture and grazing lands supplying butter. Woolen clothes, shawls, carpets and rugs are manufactured for which Srinagar is famous. Mulberry is grown abundantly as feed for silk worms. There are two silk factories, one of which is the largest of its kind in the world. It was built in 1869 and employs about 9,000 workers for reeling the raw material only. The leather industry is becoming more and more important. There are also projects under way for starting paper and match factories.

Silver, copper and stone hand made material is exported quite extensively. Such minerals as bauxite, coal, Fuller's earth, kaolin, slate, zinc, copper, talc, and gold are found in Baltislan and Gilgit, aquamarine in Skardu, sapphire in Padar and lead in Uri, iron at Sof, gypsum and limestone in various parts. All the potential minerological resources of the country have not yet been investigated on a scientific basis. Within recent years gold was discovered in Gulmarg, and coal deposits have been discovered in Laddakh, Anji and the Whampur districts. It is estimated that there are eleven million tons of workable coal in the newly discovered fields.

The State maintains a very high rate of tariff on imports and excise duty is charged on some exports.

Roads and Towns

There are three main paved roads in the State, viz., (1) Jhelum valley road which is 196 miles long and links Kashmir with India. It is said to be one of the finest mountain motor roads in the world. (2) Banihal road, 205 miles long, joins Kashmir with the North Western Railway. (3) Jammu Kathua road extends thru the mid-

dle of the province. There is a railway line running into the plains of the State.

There are few large cities, the population being mostly rural. However, there are two important ones, viz., Srinagar and Jammu. Srinagar is the summer capital of the State and is situated on the Jhelum. It is noted for the beauty of its natural scenery, and has been described aptly as the "Naples of Asia." Old ruins of a former civilization, such as Nashat, Nasiem and other gardens and parks, a network of canals, and modern golf courses, make Srinagar a most attractive place. There are many archeological ruins in the vicinity which exhibit the Greek type of architecture. Whether Hindu civilization influenced the Greeks or vice versa, is not yet determined, but there are ancient ruins of great importance in the history of the early civilization of the Hindu. There are two state colleges (technical engineering and arts and sciences), one private institute, and many high schools.

Jammu on the southern border at Tawi, is the winter capital and is surrounded by forts. Within five miles is the military station of Satwari. Just outside of the city is one of the finest colleges of higher learning in upper India, and there are also technical institutions and a system of grade and high schools.

A description of the geography of Kashmir would be incomplete without quoting Sir W. Lawrence, who was in Kashmir for more than twenty-five years. He wrote in 1895: "The valley (of Kashmir) contains nearly everything which should make life enjoyable. There is sport varied and excellent, there is scenery for the artist and layman, mountains for the mountaineers, flowers for the botanist, a vast field for the geologist and magnificent ruins for the archeologist. The epicure will find dainty fruits and vegetables cheaper here than perhaps in any part of the world, while the younger can pass delightful days in the mat house-boats moored under the shady chestnut trees."

EDITORIAL NOTES AND NEWS

Blueberry exports from Newfoundland are increasing. The 1930 crop amounted to more than 3½ million pounds. Practically all the berries were shipped frozen to the United States.

Prescott, Ontario, expects to become an eastern terminal for large lake ships now that the new Welland Canal has been opened. The Canadian Government has taken advantage of this situation and built a huge grain elevator there on land reclaimed from the St. Lawrence. The new canal has also been a boon to Port Colborne where 29 freighters were tied up for the winter. The value of each ship to the port is estimated to be about $2,000, based on the sale of supplies needed by the ship keepers during winter and on the spring outfitting requirements.

Successful geography meetings were reported this spring by Alabama, Tennessee, and Ohio. The theme of the Tennessee State Council meeting centered in various phases of the geography of South America, while that of Alabama Council featured various teaching problems in geography. The Ohio program illustrated opportunities for creative thinking offered in teaching problems and projects in geography.

The Home Study Department of Clark University, Worcester, Massachusetts, announces revised editions of the Branom and Knight Bibliographies. The cost of each per single copy is 25 cents. The title and author of each are: Fred K. Branom: A Bibliography of Recent Literature on the Teaching of Geography; Ella B. Knight: A Bibliography of Geographical Literature for Elementary Grades and Junior High Schools.

The odds game birds had to live were greatly enhanced by the passage and enforcement of the various Migratory Bird Treaties between the United States and Canada. A shot from the hunter's gun, however, was not the only man-made handicap game birds had to face. Their very existence was threatened by the changes in their natural habitat wrought by man's ruthless destruction of forests, stream pollution, fires, and the drainage of marshes and other water areas. Fortunately, a conservation act passed in 1929 is making possible the creation of great national systems of wild fowl sanctuaries. Canada has a similar program, recognizing the importance of migrating birds as assets in agriculture, as a food supply, and a source of wholesome recreation and esthetic enjoyment. Has your state any such sanctuaries?

Have you checked April 14 as Pan American Day? It was recently so proclaimed by President Hoover in accordance with a resolution by the Governing Board of the Pan American Union recommending its observance in the 21 republics comprising the Pan American Union. This particular date was chosen because it was on April 14, 1890, that the resolution creating the Pan American Union was adopted. The April, 1931, number of the Bulletin of the Pan American Union commemorates the first observance of this day. Plan a geography program for next April 14 in keeping with the purposes of this international organization.

GEOGRAPHICAL PUBLICATIONS

Edward Dana Durand. **American Industry and Commerce.** 653 pp. Maps, diagrams, index. Ginn & Company, Boston, 1930

The author of "American Industry and Commerce" has taken as his text, this statement: "The United States is universally recognized to be the richest nation in all history." In a more elaborate statement, he sets forth the purpose of the book as follows: "It is the purpose of this book to give more definite content to this often vague picture of the economic position of the United States. It aims to set forth, systematically, the major facts regarding the present riches of the country, the character and magnitude of its industries and commerce, and the history of its material development, especially during recent decades. It seeks to discover the basic causes of American prosperity and progress and to sketch the more important of those proximate and derivative forces for efficiency into which these underlying factors translate themselves. Finally, it undertakes to discuss the relation of the general economic status and trends of the country to the well-being of the masses of the population." In this statement, the phrase "definite content" is the key to the book.

His experience as Statistical Assistant to the Secretary of Commerce and former Director of the United States Bureau of Census fairly casts the mold of treatment. The titles of the chapters read like a list of volumes of the decennial census reports.

Chapters:

I. Income and Standards of Living
II. Economic Progress of the United States
III. Primary Factors in American Progress: The Population
IV. Primary Factors in American Progress: Natural Resources
V. Secondary Factors in American Progress
VI. Occupations and Branches of Industry
VII. General Economic Geography of the United States
VIII. Agriculture and Foodstuffs Industries
IX. Mining and Quarrying and Related Manufacturing Industries
X. Manufactures
XI. Transportation and Communication
XII. Foreign Trade

The explanation and interpretation in general terms represent the textual treatment of a large mass of census data. However, there are no tables of statistics. In their place have been substituted many diagrams showing grafically the quantitative aspect of the principal classes of data of the census.

The chapter on economic geography consists largely of a comparison of statistical characteristics of the divisions of the United States adopted by the Bureau of Census. They are: New England, Middle Atlantic, South Atlantic, East North Central, East South Central, West North Central, West South Central, Mountain and Pacific.

Each chapter carries a sub-topic on the geography of the particular title but in every case geography is limited to the distribution aspects. For example, in commenting on minerals, the following is noted: "The location of mining industries depends primarily on the whims of geology: mines are where minerals are found."

The reader of the book is not impressed with new material or new points of view. The geographic reader, perhaps, might obtain suitable benefit from the economic approach of the author in terms of population characteristics, standards of living, organization of business, finance, and general history. Such considerations are of great value as treated by the author when contrasted or compared with foreign lands. Considering

the purpose of the author, it is a very excellent book and would serve anyone well as a source book for general information concerning the United States.

LEWIS F. THOMAS

Washington University
St. Louis, Mo.

David Fairchild. **Exploring for Plants.** 190 original photos, 611 pp., The Macmillan Company, New York, 1930. $5.00

This book is an interestingly written, well illustrated, account of three years of field study by an exceptionally well qualified agricultural explorer of the U. S. Department of Agriculture. Dr. Fairchild has for nearly forty years been searching for plants worthy of introduction into the United States. The journeys described in this book include visits to the Canary Islands, Ceylon, Sumatra, and Java. His intimate sketches of parts of England, France, Italy, Spain, and Portugal are also decidedly worthwhile.

Dr. Fairchild is, of course, a good observer and in this straight-forward account of his experiences day by day he tells of many things that will interest teachers of geography, and alert pupils. The photographs include many that will interest even elementary pupils.

Many geography teachers will welcome this book for reference use concerning the chief areas described, and for its satisfactory presentation of the important work of plant introduction. One of the notable contributions made by Americans to agriculture is the introduction, often from remote localities, of plants that are now yielding valuable products or beauty, to many people in America. Dr. Fairchild's work, mostly with tropical trees, shrubs and vines, as set forth in this book, is an excellent example of the difficulties and advantages of the work of plant explorers.

This book deserves a place in geography libraries, and many geography teachers will obtain much pleasure, for a long time to come, from their personal copies.

S. S. VISHER

Indiana University

Mark Jefferson. **Exercises in Human Geography.** Ann Arbor Press, Ann Arbor, Michigan.

Publication of Exercises in Human Geography marks another characteristic contribution by Mark Jefferson to work in geography. This contribution is in the field of laboratory manuals and work books.

It has the earmarks of a practical and teachable manual for use in laboratory work in geography of college grade. It is a refreshing and somewhat different presentation.

On the title page appears "Our geography is mainly concerned with Men—Where they are and what they are like." To this it might well be added "And why they are as they are" in order to emphasize the interpretative phrase of the subject as developed in the exercises of the book.

The twenty-four exercises of the book seem to be built, directly or indirectly, around the interpretation of the distribution and density of population of the earth as shown by the maps pp. 2 and 3. Human occupancy is developed, with emphasis on sparsely settled areas, as conditioned by (1) too little rain, (2) too much rain, (3) insect pests, (4) lack of soil, (5) accessibility.

Each exercise consists of textual material interspersed with questions. Grafic work to be done by the student is provided by including outline maps upon which various relationships are to be expressed. Exercise 36 is the construction of a map on the conic projection. Exercises 37 and 38 develop the use of map scales.

The fallacy in some commonly accepted statements is exemplified e.g. "that the *warm* Gulf Stream as such, reaches Europe and modifies its climate." The relation of temperatures at high altitudes to adiabatic cooling is shown clearly.

This book of exercises could be improved by clear reference citations. What is the Philips Atlas mentioned near the middle of Page 99? Is it the same which is properly referred to on page 116? The reviewer finds no Figure 41 mentioned on page 93. The implied and literal meanings of some statements are open to challenge on the basis of accuracy.

In the pocket at the back of the book are twelve plates of well chosen pictures.

This book of exercises should find a considerable field of usefulness in the foundation course in geography in Liberal Arts and Teachers Colleges.

ROY SCHOFIELD

State Teachers College
Bemidji, Minn.

C. K. Leith. **World Minerals and World Politics.** 225 pp. McGraw-Hill Book Co., New York, 1931. $2.00

This book by the distinguished chairman of the Department of Geology at the University of Wisconsin and chairman of various important committees of inquiry concerning minerals is of interest and value to all teachers of geography. It presents, in readable form, the conclusions of the world's leading authority on the subject dealt with. These conclusions are based upon a body of knowledge concerning minerals which is much greater than was available only a few years ago. Furthermore developments in mineral exploration have been so rapid in recent years that geographers will all welcome this up-to-date summary as to the status of production in all parts of the world.

This book has been written for the general reader; it is not technical, contains no tables and few statistics. Many of its conclusions are so simply stated, and of such obvious significance that they can be appreciated and understood by even elementary students. In other words, this book should be read by all teachers of geography, and should be used freely as a reference book in school libraries. It will notably increase the appreciation of the interdependence of the various parts of the world, and the need for scientific study and farsighted policies.

The scope of the book is suggested by the chapter titles: 1. New Elements in the Mineral Picture. 2. The Future Geography of Mineral Resources. 3. The Mineral Position of the Nations. 4. What the Nations are Doing Politically in Respect to Minerals. 5. The Nature of Specific Political Measures. 6. Conservation. 7. Minerals and War. 8. The Mineral Future and Politics. Appendices: The Mineral Inquiry, Reports of the Committee on Domestic and Foreign Mining Policy of the Mining and Metallurgical Society of America. Index.

The following quotations or abstracts suggest something as to the significance of this book: "Countries bordering the North Atlantic, particularly the United States and Western Europe, are the fortunate possessors of essential minerals in amounts and combinations necessary for industrial strength." "The mineral industries of other parts of the world must continue to be subordinate or tributary to those of the North Atlantic countries because of the fundamental deficiences in raw materials." "The continued political and military predominance of the North Atlantic region seems to be indicated for the future." The real exploitation of minerals commenced only a little more than a century ago. "Minerals now constitute about a quarter of all ocean-borne traffic." "Few years pass without a use being found for some mineral hitherto regarded as worthless." "The list of commercial minerals now

includes over seventy-seven minerals.'' ''Nearly a third of the world's mineral tonnage moves across international boundaries. Of this third, coal, oil and iron constitute the great mass.'' ''Fully three-quarters of the world's mineral production and reserves are controlled from the United States and Great Britain. Commercial units of other countries have been hopelessly outdistanced.'' ''Considered broadly, exhaustion of lower grade reserves is still very far in the future, but the world is rapidly passing out of the stage of exploitation of its richest and most accessible mineral deposits into a stage of production based on lower grade deposits of longer life. In this stage, geographic shifts will be fewer, slower, and more easily and certainly anticipated.'' ''Except for oil, a major source of minerals has not been discovered in Europe since 1850, in the United States since 1910. The important discoveries since 1910 lie in Central Africa, Canada, South America and Australia.'' With the aid of airplane reconnaissance and photography, geophysical methods of exploration, effective drilling, and underground work, and highly trained experts, as much exploration is now done in one year as was done in many years together before 1900. The steady dwindling of results brings conviction that we are approaching the limit of discovery of major mineral areas. The United States is the outstanding mineral country. It accounts for about 40 per cent of the world's totals of production, consumption, and ownership. It is the only country in the world possessing adequate supplies of nearly all of the principal industrial minerals. Notwithstanding, it depends almost entirely on foreign sources for several important minerals: antimony, chromite, manganese, nickel, tin, asbestos, bauxite, platinum and potash, and is very largely dependent also for mercury, tungsten, barite and mica. The British Empire as a whole lacks only a few minor minerals. Germany has a smaller supply of essential minerals either at home or abroad than has any other important industrial nation. ''The interdependence of nations and specialization in mineral production have been determined once and for all by nature's distribution of minerals.''

STEPHEN S. VISHER

Indiana University

W. H. Voskuil. **Minerals in Modern Industry.** 360 pp.; 4 figs., bibliography, index. John Wiley and Sons, New York, 1930. $3.75

This book presents many data concerning minerals, with the use of numerous statistical tables. The point of view is historical and economic. The presentation is rather detailed and somewhat technical, but most teachers of geography can easily obtain and will welcome some of the information given. Especially valuable are the discussions of the various important minerals and the summaries as to the relative importance and special problems of each of the chief sources of supply of that mineral. About half of the book is devoted to the fuels. The discussion of the coal industry and its problems affords an excellent summary of many more elaborate studies. The four chapters on petroleum contain many excellent paragraphs. The geographic libraries of colleges, normal schools and the larger high schools should find this a worth-while addition.

STEPHEN S. VISHER

Indiana University

Lenox E. Chase. **Problem Studies in Economic Geography.** 120 pp. Prentice-Hall, N.Y., 1931.

The book is organized in two parts: I. The United States. II. Foreign Nations and Their Trade Relations with the United States. The organization is conventional in following the ''commodity'' plan of treatment of economic products in Part I,

with sections dealing with transportation, manufacturing, and trade included. The motivating theme in Part II is expressed in the title of that part. The material provided will fit in with most texts in use at the secondary school level.

From the pedagogical standpoint the book shows painstaking thought and preparation. Individual differences are provided for thru "extra credit" assignments. Tests are provided at the conclusion of each unit of work. These tests generally are grouped as "memory" questions and "reasoning" questions. The so-called "memory" questions are largely factual questions involving ability in geographical interpretation, and are of much higher quality than the name might indicate. The quantitative data compiled and put in usable form are a distinct contribution in checking and emphasizing facts of geographic significance.

Possibly the historical, economic, and political aspects of economic geography receive undue consideration as compared to the simple direct relationships between economic activities and the natural environment. In addition to being a stimulating workbook in geography, the publication provides many suggestive problems related to geography. It is a welcome addition to its particular field.

LYNN H. HALVERSON

State Teachers College
Marquette, Michigan

INTEREST-STIMULATING DEVICES

These devices have proved effective in connection with journey geography.

I.

1. Have a collection of pictures on the region being visited. These should be mounted in order to keep them in good condition. The National Geographic furnishes a good source of material.
2. Tell the children that the pictures which we have taken on our travels have been developed and came out very well. Would they like to see them?
3. Give one picture to each pupil, or to a part of the class, depending on the number of pictures available.
4. Each child in turn stands before the class with his picture. He tells briefly what is shown in the picture. Then he states the reason why he took this particular picture with his camera.
5. The teacher's part is to help the children to interpret the pictures from a geographic viewpoint.

II.

1. Draw a very large box upon the blackboard.
2. Print the words upon the box: Magic Souvenir Box.
3. Each child purchases an imaginary souvenir in the region we are visiting.
4. The pupils in turn approach the board and drop the souvenir into the box, speaking somewhat as follows: "This is for my mother—a lovely set of dishes from Limoges."

ELIZABETH MACMANAMY

Silver Lake School
Athol, Massachusetts